Technical Memorandum

To: Jim Christiansen
From: Jim Fricke

Date: July 23, 2003

RE: Baseline Ecological Risk Assessment

On July 10, 2003, RMC, on behalf of United Park City Mines (United Park), submitted to the Environmental Protection Agency (EPA) surface water and sediment data collected for the Baseline Ecological Risk Assessment (BERA). This technical memorandum has been prepared to discuss those data and propose alternatives for discussion with the Ecological Technical Assistance Group (ETAG). It is my understanding that you have asked Kerry Gee, United Park, to arrange a conference call with the ETAG members to discuss the data and determine the next steps in the BERA process.

Surface Water:

Six (6) surface water samples were collected on June 3, 2003 and one duplicate surface water sample was collected for QA/QC purposes (Figure 1). A water elevation and flow direction survey was conducted on July 3, 2003 in the wetland area. The results of the water elevation and flow direction survey are presented in Figure 2. Based on the water elevation and flow data areas located in the northern portion of the wetland (e.g. surface water sample stations RFB-SW-SD4 and RFB-SW-SD7) are influenced by and receiving water from Silver Creek. Surface water sampling results are presented in Table 1.

Based on the major ion chemistry, a Piper plot was developed showing representative groundwater and surface water types at the site. As shown on this plot (Figure 3), wetland surface water samples collected at SD-7 are very similar in major ion chemistry to Silver Creek surface water (RF-7-2, RF-8) and wetlands groundwater (RT-7). Wetland surface water sample SD-4 plots as a mixture between Silver Creek surface water (RF-7-2, RF-8) and surface water originating from the South Diversion Ditch (SD-13, SD-17, SD-18, SD-20), which are very tightly grouped in all sectors of the plot. . The Focused Remedial Investigation Report (RMC, 2002) discusses the geochemical relationships between Silver Creek surface water, alluvial groundwater, wetland groundwater and the diversion ditch.

Based on surface and groundwater data collected in the wetland it appears that there is very little transport of metal from the sediments to either of these media. Groundwater data collected from RT-7, located approximately 30 feet south of SD-7, (*See*, RI Report, RMC, 2002) indicate that the groundwater in the wetland is not impacted by either the sediments or surface water.

Therefore, the preliminary interpretation based on both water-level elevation data and major ion chemistry is that Silver Creek greatly influences the hydrology and water chemistry of much of the wetland area.

Sediment:

Twenty sediment samples were collected on June 4, and June 5, 2003, two duplicate sediment samples were collected for QA/QC purposes. Sediment sample results are presented in Table 2. Exponent has completed an initial analysis of the available sediment chemistry data from the recent sampling of the wetland and the pond at the Richardson Flats site. Sediment chemistry data were compared to available sediment quality guidelines initially using a hazard quotient (HQ), or ratio of chemical concentration to sediment effect concentration (SEC) for each metal at a station. An indicator of the potential for toxicity at each station was derived by summing the HQ values for metals to calculate a hazard index (HI). Table 3 presents the results of the analysis.

The HI approach was used to estimate the relative toxicity of the sediment at each station. The SEC values used in this evaluation are the no-effects concentrations (NECs) derived from freshwater sediment toxicity tests as developed by Ingersoll et al. (1996). Where NECs were not available (for silver, mercury, and antimony), the upper effects threshold (UETs) from the NOAA SQUIRT benchmark database (NOAA 1999) were used.

The NECs were developed using an Apparent Effects Threshold (AET) approach for 14-day Chironomus riparius (survival and growth), and 14- and 28-day amphipod (Hyalella azteca) survival, growth, and sexual maturation. These are the same endpoints that have been proposed for the Richardson Flat site sediment bioassays. A NEC is calculated as the maximum concentration of a chemical in sediment that did not significantly adversely effect the particular endpoint (e.g., survival, growth). If all chemical concentrations are below their AET or NEC for a specific response then no adverse effect would be expected (Ingersoll et al. 1996). The UET is also an AET-based value. It is the lowest AET from endpoints compiled by NOAA (1999).

The results of the calculations show that SD10 has the highest HI, SD12 and SD13 have approximately the mean HI, and SD08 has the lowest HI of all wetland stations. The pond samples had the lowest HIs of all sediment samples at Richardson Flat. The HI for SD10 is high because of the HQs for lead, antimony, and silver. Lead and antimony were generally the primary drivers of the higher HIs, followed by zinc, silver, and cadmium. Please note that this screening exercise was undertaken solely to estimate relatively toxic potential for sediment at each station, for the purposes of identifying a toxicity gradient for choosing a subset of stations for biological testing. The HQs and HIs do not represent risk estimates. The actually toxicity of sediments can only be determined by biological testing, because the use of available sediment quality guidelines in the HI analysis may not reflect the potentially low bioavailability of metals in the sediment matrix present at the site.

Exponent also conducted a principle components analysis (PCA), which helps identify the sets of metals responsible for most of the variation in concentrations in the wetland.

The following conclusions can be drawn from the PCA and HI analyses:

- Metals are widely distributed across the wetland and pond at levels indicative of sediments potentially contaminated by mine tailings or drainage from mining areas.
- The sediments are spatially heterogeneous in their metals composition; i.e., the relative concentrations of metals vary widely among locations.
- Station SD08 has the lowest HI, SD12 and SD13 have the mean HI, and SD10 has the highest HI.
- The HI for SD10 is high because of the HQs for lead, antimony, and silver.
- Lead and antimony were generally the primary drivers of the higher HIs, followed by zinc, silver, and cadmium.
- The pond samples had the lowest HIs of all sediment samples at Richardson Flat.

Based on the heterogeneous sediment chemistry, the approach to deriving an exposure-response relationship based on sediment toxicity testing and chemistry at a small subset of stations (as suggested during a conference call with EPA) may not be appropriate at this site. The most appropriate approach for deriving site-specific sediment criteria at the site is the Apparent Effects Threshold (AET) approach. United Park will proceed with additional data gathering and analysis if the ETAG group is comfortable with the sediment chemistry data collected to date. In other words, do the current sediment metal concentrations exceed a comfort level within the various agencies in the ETAG group? Various issues we would like the ETAG to consider include:

- The ecological habitat value of the wetland.
- The potentially low bioavailability of the metals in sediment (neutral pH, reducing conditions, the possibility that the metals may be associated with sulfide minerals and thus immobile).
- Based on knowledge gained from other sites in Region 8 where metals concentrations and environmental conditions may be similar, would the concentrations in the Richardson Flat wetland pose an ecological risk?
- Would biological testing (e.g., sediment bioassays, tissue analyses) at a subset of the stations originally proposed be adequate to satisfy the requirements of the agency's ecological risk assessment even if the data were not adequate to develop AETs?

Alternative approaches to deriving site-specific sediment criteria should be discussed with the ETAG group in the upcoming conference call.

CC: Kerry Gee
Kevin Murray
Dale Hoff
Dan Wall
Mohammed Slam
Chris Cline
Linda Ziccardi
Rob Pastorok

Color Map(s)

The following pages contain color that does not appear in the scanned images.

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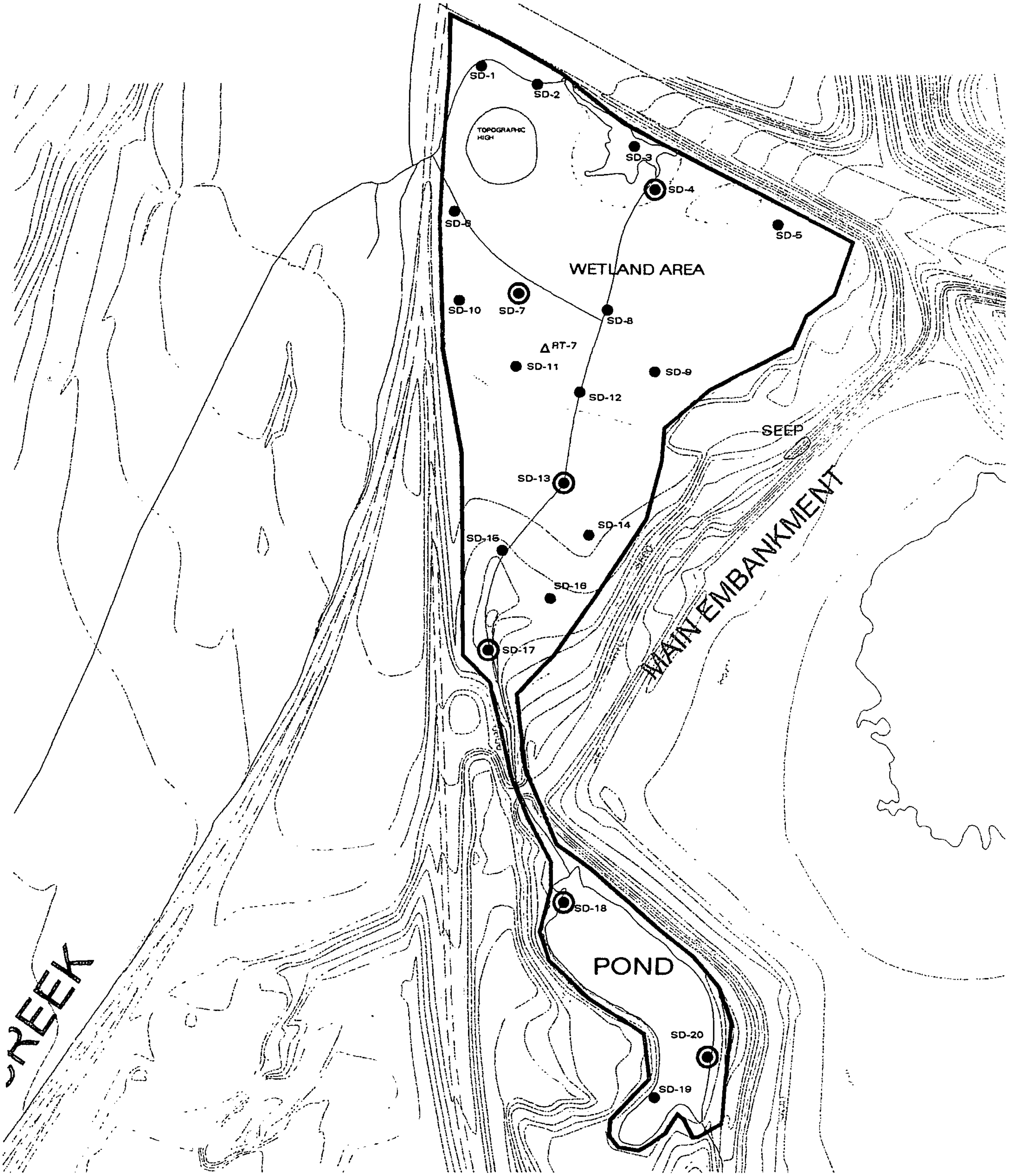


LEGEND

● SEDIMENT SAMPLE LOCATION

◉ SEDIMENT AND SURFACE WATER SAMPLE LOCATION

ECOLOGICAL STUDY AREA BOUNDARY

△ PIEZOMETER

N

SCALE
0 50 100 150 200
FEET

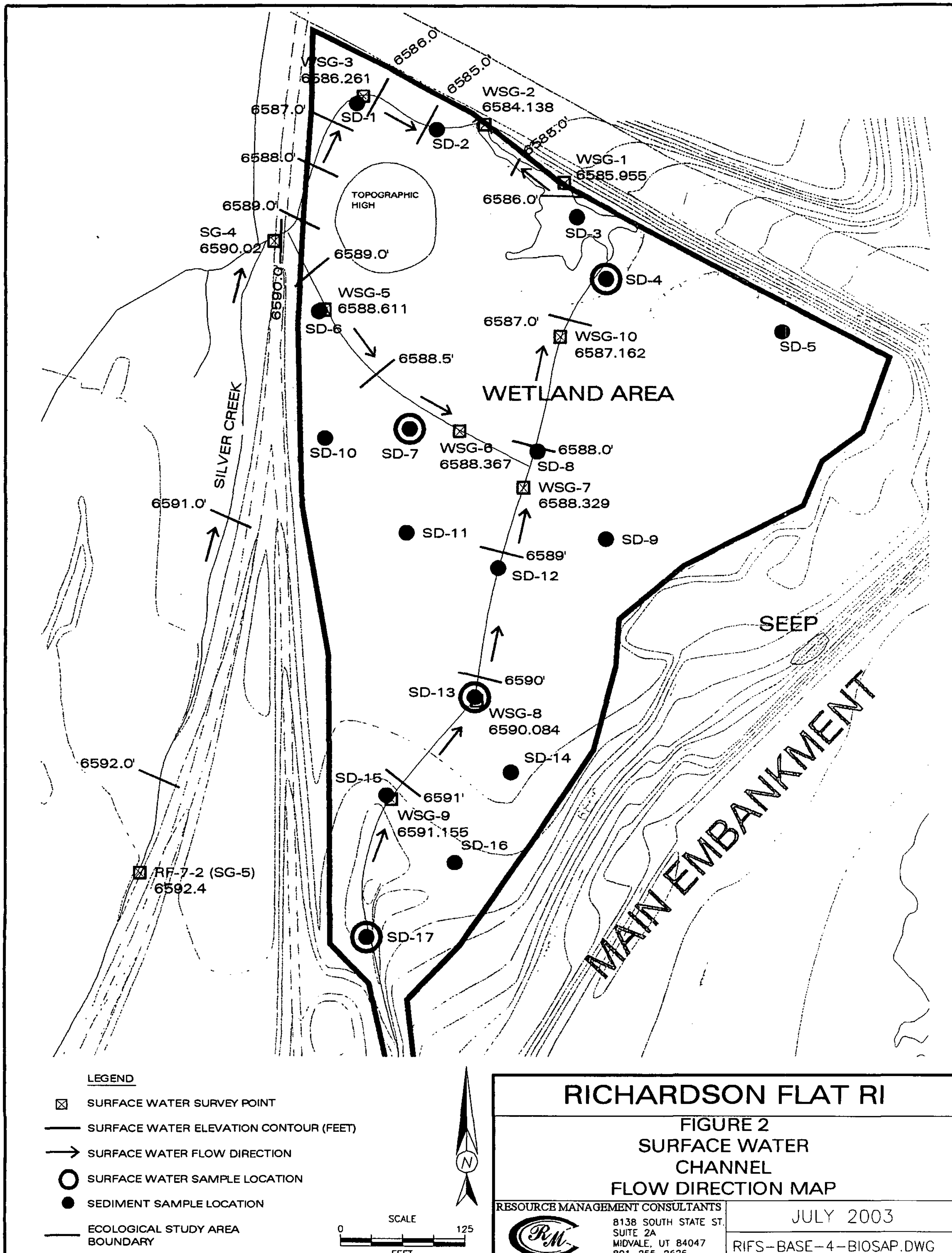
RICHARDSON FLAT RI

FIGURE 1
WETLAND AND POND AREA
SAMPLE LOCATION MAP

RESOURCE MANAGEMENT CONSULTANTS
RMC
8138 SOUTH STATE ST.
SUITE 2A
MIDVALE, UT 84047
801-255-2626

JULY 2003

RIFS-BASE-4-BIOSAP.DWG



RICHARDSON FLAT RI

FIGURE 2
SURFACE WATER
CHANNEL
FLOW DIRECTION MAP

RESOURCE MANAGEMENT CONSULTANTS
8138 SOUTH STATE ST.
SUITE 2A
MIDVALE, UT 84047
801-255-2626

JULY 2003

RIFS-BASE-4-BIOSAP.DWG

Figure 3. Piper Plot of Representative Waters, Richardson Flat Tailings Site

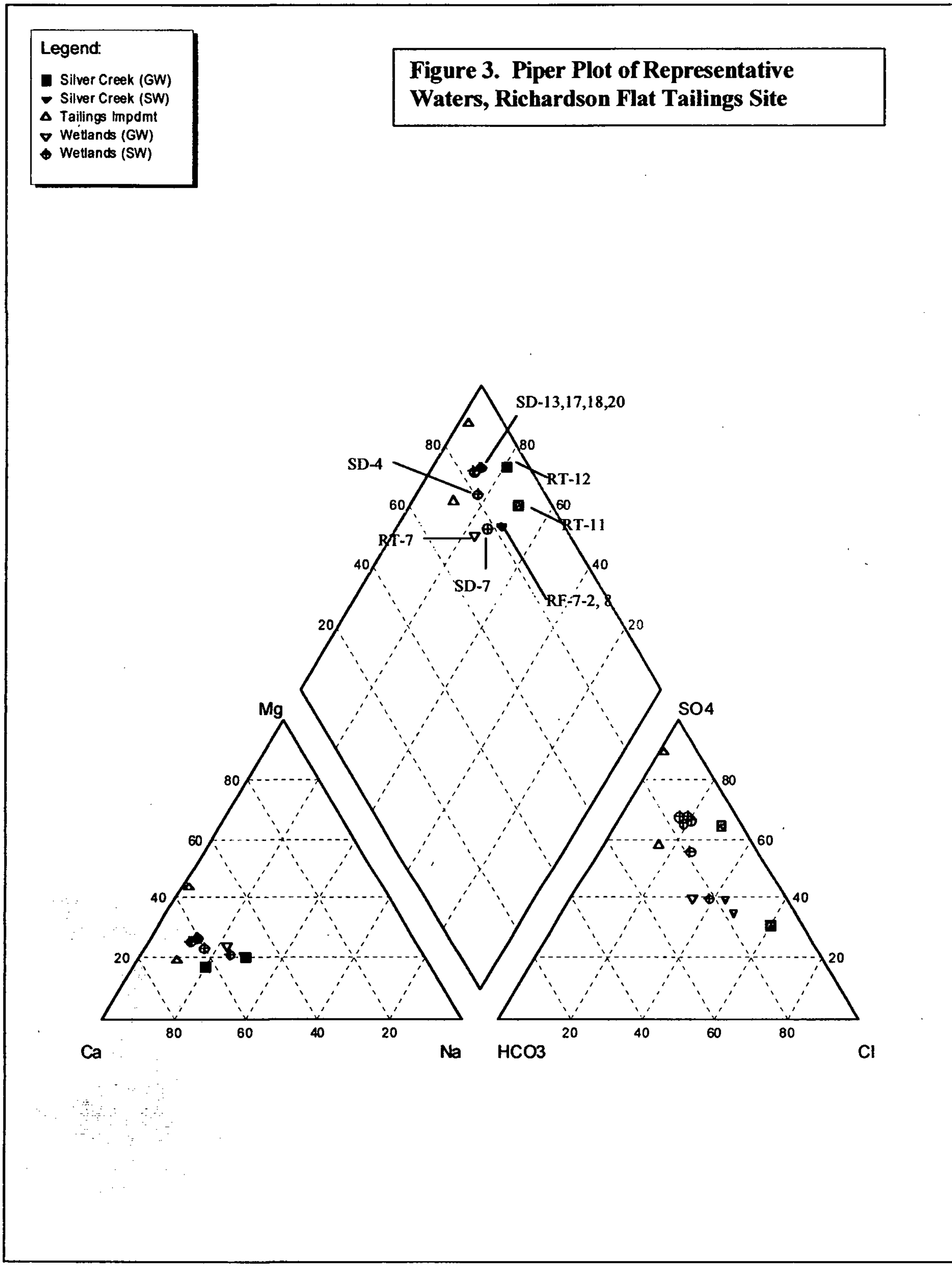


Table 1, Richardson Flat Analytical Results Summary,
2003 Wetland Area Surface Water Sampling

units mg/l

Date	Sample #	AG	AG(D)	AL	AL(D)	ALK.	AS	AS(D)	B	B(D)	BA	BA(D)	BE	BE(D)	CA(D)	CAT/AN BAL.	CD	CD(D)	CL-	CN-	CO3	CO	CO(D)	COND.	CR	CR(D)	CR+6(D)
3-Jun-03	RFB-SW-SD4	<0.005	<0.005	<0.050	<0.050	200	0.008	0.007	<0.10	<0.10	<0.10	<0.10	<0.005	<0.005	207	1.2	<0.001	<0.001	156	<0.004	<2.0	<0.10	<0.10	1554	<0.010	<0.010	<0.005
3-Jun-03	RFB-SW-SD7	<0.005	<0.005	0.063	<0.050	180	0.008	<0.005	<0.10	<0.10	<0.10	<0.10	<0.005	<0.005	155	2.5	0.003	<0.001	187	<0.004	<2.0	<0.10	<0.10	1401	<0.010	<0.010	<0.005
3-Jun-03	RFB-SW-SD13	<0.005	<0.005	<0.050	<0.050	189	<0.005	<0.005	<0.10	<0.10	<0.10	<0.10	<0.005	<0.005	262	3.6	<0.001	<0.001	128	<0.004	<2.0	<0.10	<0.10	1784	<0.010	<0.010	<0.005
3-Jun-03	RFB-SW-SD17	<0.005	<0.005	<0.050	<0.050	177	<0.005	<0.005	<0.10	<0.10	<0.10	<0.10	<0.005	<0.005	251	4.8	<0.001	<0.001	106	<0.004	<2.0	<0.10	<0.10	1742	<0.010	<0.010	<0.005
3-Jun-03	RFB-SW-SD18	<0.005	<0.005	<0.050	<0.050	148	<0.005	<0.005	<0.10	<0.10	<0.10	<0.10	<0.005	<0.005	230	3.2	<0.001	<0.001	117	<0.004	<2.0	<0.10	<0.10	1674	<0.010	<0.010	<0.005
3-Jun-03	RFB-SW-SD5018	<0.005	<0.005	<0.050	<0.050	148	<0.005	<0.005	<0.10	<0.10	<0.10	<0.10	<0.005	<0.005	230	4.4	<0.001	<0.001	121	<0.004	<2.0	<0.10	<0.10	1677	<0.010	<0.010	<0.005
3-Jun-03	RFB-SW-SD20	<0.005	<0.005	<0.050	<0.050	144	<0.005	<0.005	0.1	<0.10	<0.10	<0.10	<0.005	<0.005	237	5	<0.001	<0.001	127	<0.004	<2.0	<0.10	<0.10	1691	<0.010	<0.010	<0.005

Date	Sample #	CU	CU(D)	FE	FE(D)	HARD	HCO3	HG	HG(D)	K(D)	KJEL-N	MG(D)	MN	MN(D)	NA(D)	NH3/N	NO2/NO3	P	PB	PB(D)	PH	SB	SB(D)	SE	SE(D)	SO4=	TDS	TOC	TSS	ZN	ZN(D)
3-Jun-03	RFB-SW-SD4	0.006	0.005	0.24	<0.10	719	200	<0.0002	<0.0002	<2.0	<0.50	49	0.61	0.58	65	0.24	0.13	<0.10	<0.005	<0.005	7.6	<0.005	0.007	<0.004	<0.004	476	1141	4.6	<1.0	0.71	0.87
3-Jun-03	RFB-SW-SD7	<0.005	<0.005	1.1	<0.10	539	180	<0.0002	<0.0002	<2.0	<0.50	37	0.91	0.34	82	<0.10	<0.10	0.22	0.008	<0.005	7.5	<0.005	<0.005	<0.004	<0.004	260	939	3.8	5.3	1.1	0.82
3-Jun-03	RFB-SW-SD13	0.007	0.006	0.14	<0.10	922	189	<0.0002	<0.0002	2.8	<0.50	65	2.3	2.2	55	<0.10	<0.10	<0.10	<0.005	<0.005	7.6	<0.005	<0.005	<0.004	<0.004	611	1451	4.9	3.2	0.051	0.023
3-Jun-03	RFB-SW-SD17	0.007	0.006	0.13	<0.10	888	177	<0.0002	<0.0002	3.2	<0.50	63	2.2	2	54	0.12	0.16	<0.10	<0.005	<0.005	7.6	<0.005	<0.005	<0.004	<0.004	585	1384	6	4.7	0.036	0.012
3-Jun-03	RFB-SW-SD18	0.007	0.006	0.12	<0.10	830	148	<0.0002	<0.0002	2.3	<0.50	62	1.9	1.8	55	<0.10	<0.10	<0.10	<0.005	<0.005	7.6	<0.005	<0.005	<0.004	<0.004	583	1361	6.4	7.3	<0.010	<0.010
3-Jun-03	RFB-SW-SD5018	0.007	0.006	0.12	<0.10	834	148	<0.0002	<0.0002	2.3	<0.50	63	1.9	1.8	56	0.14	<0.10	<0.10	<0.005	<0.005	7.5	<0.005	<0.005	<0.004	<0.004	562	1353	7	5.2	<0.010	<0.010
3-Jun-03	RFB-SW-SD20	0.006	0.006	0.14	<0.10	855	144	<0.0002	<0.0002	2.4	<0.50	64	1.9	1.8	58	<0.10	<0.10	<0.10	<0.005	<0.005	7.6	<0.005	<0.005	<0.004	<0.004	569	1354	7.2	4.7	<0.010	<0.010

Note:
Sample RFB-SW-SD5018 is a duplicate of RFB-SW-SD18

Table 2, Richardson Flat Analytical Results Summary,
2003 Wetland Area Sediment Sampling
units ppm

Date	Sample #	AG	AL	AS	BA	BE	CD	CO	CR	CU	FE	HG	MN	MOIST.	NI	PB	PH	S=	SB	SE	TL	V	ZN
4-Jun-03	RFB-SED-SD01	30.5	6700	159	173	0.3	52	15	38	255	40300	3.69	2290	39.1	21	3200	6.6	63	67	9.2	4.5	12	13400
4-Jun-03	RFB-SED-SD02	30.3	11200	202	55	0.5	98	17	49	436	49900	4.74	1910	54.2	23	4800	6.5	113	59	12.1	5.8	22	14500
4-Jun-03	RFB-SED-SD03	35.3	17800	137	146	0.8	55	14	33	457	29500	1.49	6710	69	20	2490	6.6	1359	52	6.7	8.7	34	13200
4-Jun-03	RFB-SED-SD04	56.5	15100	356	208	0.5	58	17	44	563	36000	3.62	3730	58.4	29	5280	6.5	324	72	8	11	27	9340
4-Jun-03	RFB-SED-SD504	56	15600	235	274	0.5	36	10	27	416	37200	3.2	3900	59.1	18	3360	6.6	32	73	8	11	20	9720
4-Jun-03	RFB-SED-SD05	40.6	6760	447	91	0.3	62	9.7	21	643	59900	1.36	3490	71.5	16	3920	6.7	823	109	8.2	21	7	22600
4-Jun-03	RFB-SED-SD06	44	24200	422	337	1.2	72	19	42	598	42100	4.02	2730	69.7	30	5240	6.7	824	66	9.8	6.5	48	12100
4-Jun-03	RFB-SED-SD07	28	12200	333	137	0.4	83	8.9	28	509	35700	1.23	3460	86.6	16	4430	7.3	1086	73	8.7	15	18	11100
4-Jun-03	RFB-SED-SD08	31.2	11630	168	146	0.4	24	9	25	418	18800	1.14	6870	85.4	21	3520	6.9	131	103	8.6	21	16	11000
5-Jun-03	RFB-SED-SD09	56	15500	261	200	0.4	53	26	39	505	33200	3.84	10800	53.6	29	5650	7.2	3925	80	7.5	<2.5*	25	9460
5-Jun-03	RFB-SED-SD10	56.3	6500	208	224	0.5	37	4.3	24	613	13900	2.06	1740	83.7	14	5860	5.8	303	169	11.9	12	13	6330
5-Jun-03	RFB-SED-SD11	42.3	4700	248	243	0.2	78	14	68	523	17700	3.23	2390	46.1	32	5240	6.8	1114	127	10.6	15	9	9560
5-Jun-03	RFB-SED-SD12	17.2	5530	104	156	0.2	42	12	54	218	17000	1.05	4090	34.9	24	2480	6.9	1722	45	4.8	7.1**	11	7190
5-Jun-03	RFB-SED-SD13	19.1	6030	118	138	0.2	47	11	39	218	23800	1.21	4500	24.3	19	2430	6.7	1231	43	6.8	<5.0*	10	7490
5-Jun-03	RFB-SED-SD14	28.6	8090	119	28.7	0.2	29	9.9	16	724	55600	0.54	7080	76.5	9	2430	7.3	695	67	6.9	<2.5*	9	6580
5-Jun-03	RFB-SED-SD15	20.9	5020	118	527	0.2	34	30	56	124	21100	0.33	61500	43.3	35	1510	8.1	1066	29	3.5	<20**	14	10600
5-Jun-03	RFB-SED-SD16	35.7	14500	265	90.9	0.4	52	9.9	17	327	46700	0.94	2020	71.9	13	3320	6.5	2594	97	7.5	8.1**	18	15600
5-Jun-03	RFB-SED-SD17	25.7	6010	55	1490	0.3	6.8	28	46	27	8480	0.05	161000	68.9	28	250	7	<20	27	1.1	<40**	14	9150
5-Jun-03	RFB-SED-SD18	6.95	17100	36	149	0.5	7.3	12	41	145	20400	0.61	1060	35.9	24	1040	7	2165	15	2.8	<2.5	23	2380
5-Jun-03	RFB-SED-SD19	10.6	12000	50	128	0.3	8.1	9	25	126	16800	0.78	625	66.9	14	1170	7	680	28	4.9	3.7	16	2430
5-Jun-03	RFB-SED-SD5019	10	12300	59	119	0.3	12	12	42	181	24100	1.18	818	56.9	22	1520	6.8	734	23	4.9	<2.5	19	2370
5-Jun-03	RFB-SED-SD20	3.77	9460	50	148	0.4	7.1	13	28	81	20500	0.06	4880	70.2	20	455	6.9	660	15	2.8	5.9	22	2790

Notes:
Sample RFB-SED-SD504 is a duplicate of RFB-SD04
Sample RFB-SED-SD5019 is a duplicate of RFB-SD19

Table 3. Preliminary screening of Richardson Flat wetland and pond sediment for selected metals

Date	Sample #	AG	AL	AS	CD	CR	CU	FE	HG	MN	NI	PB	SB	ZN	AG	AL	AS	CD	CR	CU	FE	HG	MN	NI	PB	SB	ZN	Hazard Index	
	NEC:		73000	100	8	95	580	29000		4500	43	130		1300	INDIVIDUAL HAZARD QUOTIENTS (HQs)													(HI)	
	UET:	4.5							0.56				3																
Wetland Stations																													
4-Jun-03	RFB-SED-SD01	30.5	6700	159	52	38	255	40300	3.69	2290	21	3200	67	13400	6.8	0.1	1.6	6.5	0.4	0.4	1.4	6.6	0.5	0.5	24.6	22.3	10.3	82	
4-Jun-03	RFB-SED-SD02	30.3	11200	202	98	49	436	49900	4.74	1910	23	4800	59	14500	6.7	0.2	2.0	12.3	0.5	0.8	1.7	8.5	0.4	0.5	36.9	19.7	11.2	101	
4-Jun-03	RFB-SED-SD03	35.3	17800	137	55	33	457	29500	1.49	6710	20	2490	52	13200	7.8	0.2	1.4	6.9	0.3	0.8	1.0	2.7	1.5	0.5	19.2	17.3	10.2	70	
4-Jun-03	RFB-SED-SD04	56.5	15100	356	58	44	563	36000	3.62	3730	29	5280	72	9340	12.6	0.2	3.6	7.3	0.5	1.0	1.2	6.5	0.8	0.7	40.6	24.0	7.2	106	
4-Jun-03	RFB-SED-SD05-AV	48.3	11180	341	49	24	529.5	48550	2.28	3695	17	3640	91	16160	10.7	0.2	3.4	6.1	0.3	0.9	1.7	4.1	0.8	0.4	28.0	30.3	12.4	99	
4-Jun-03	RFB-SED-SD06	44	24200	422	72	42	598	42100	4.02	2730	30	5240	66	12100	9.8	0.3	4.2	9.0	0.4	1.0	1.5	7.2	0.6	0.7	40.3	22.0	9.3	106	
4-Jun-03	RFB-SED-SD07	28	12200	333	83	28	509	35700	1.23	3460	16	4430	73	11100	6.2	0.2	3.3	10.4	0.3	0.9	1.2	2.2	0.8	0.4	34.1	24.3	8.5	93	
4-Jun-03	RFB-SED-SD08	31.2	11630	168	24	25	418	18800	1.14	6870	21	3520	103	11000	6.9	0.2	1.7	3.0	0.3	0.7	0.6	2.0	1.5	0.5	27.1	34.3	8.5	87	~MEAN
5-Jun-03	RFB-SED-SD09	56	15500	261	53	39	505	33200	3.84	10800	29	5650	80	9460	12.4	0.2	2.6	6.6	0.4	0.9	1.1	6.9	2.4	0.7	43.5	26.7	7.3	112	
5-Jun-03	RFB-SED-SD10	56.3	6500	208	37	24	613	13900	2.06	1740	14	5860	169	6330	12.5	0.1	2.1	4.6	0.3	1.1	0.5	3.7	0.4	0.3	45.1	56.3	4.9	132	MAX
5-Jun-03	RFB-SED-SD11	42.3	4700	248	78	68	523	17700	3.23	2390	32	5240	127	9560	9.4	0.1	2.5	9.8	0.7	0.9	0.6	5.8	0.5	0.7	40.3	42.3	7.4	121	
5-Jun-03	RFB-SED-SD12	17.2	5530	104	42	54	218	17000	1.05	4090	24	2480	45	7190	3.8	0.1	1.0	5.3	0.6	0.4	0.6	1.9	0.9	0.6	19.1	15.0	5.5	55	MIN
5-Jun-03	RFB-SED-SD13	19.1	6030	118	47	39	218	23800	1.21	4500	19	2430	43	7490	4.2	0.1	1.2	5.9	0.4	0.4	0.8	2.2	1.0	0.4	18.7	14.3	5.8	55	
5-Jun-03	RFB-SED-SD14	26.6	8090	119	29	16	724	55600	0.54	7080	9	2430	67	6580	5.9	0.1	1.2	3.6	0.2	1.2	1.9	1.0	1.6	0.2	18.7	22.3	5.1	63	
5-Jun-03	RFB-SED-SD15	20.9	5020	118	34	56	124	21100	0.33	61500	35	1510	29	10600	4.6	0.1	1.2	4.3	0.6	0.2	0.7	0.6	13.7	0.8	11.6	9.7	8.2	56	
5-Jun-03	RFB-SED-SD16	35.7	14500	265	52	17	327	46700	0.94	2020	13	3320	97	15600	7.9	0.2	2.7	6.5	0.2	0.6	1.6	1.7	0.4	0.3	25.5	32.3	12.0	92	
5-Jun-03	RFB-SED-SD17	25.7	6010	55	6.8	46	27	8480	0.05	161000	28	250	27	9150	5.7	0.1	0.6	0.9	0.5	0.0	0.3	0.1	35.8	0.7	1.9	9.0	7.0	62	
Pond Stations																													
5-Jun-03	RFB-SED-SD18	6.95	17100	36	7.3	41	145	20400	0.61	1060	24	1040	15	2380	1.5	0.2	0.4	0.9	0.4	0.3	0.7	1.1	0.2	0.6	8.0	5.0	1.8	21	
5-Jun-03	RFB-SED-SD19	10.3	12150	54.5	10.05	33.5	153.5	20450	0.98	721.5	18	1345	25.5	2400	2.3	0.2	0.5	1.3	0.4	0.3	0.7	1.8	0.2	0.4	10.3	8.5	1.8	29	
5-Jun-03	RFB-SED-SD20	3.77	9460	50	7.1	28	81	20500	0.06	4880	20	455	15	2790	0.8	0.1	0.5	0.9	0.3	0.1	0.7	0.1	1.1	0.5	3.5	5.0	2.1	16	

All concentrations are reported in mg/kg, dry weight.
Duplicate samples were averaged.
Min, max, mean were calculated for wetland sediments only and do not include pond data.
NEC: No effect concentration (Ingersoll et al. 1996)
UET: Upper Effects Threshold (NOAA 1999)
HQs not calculated for barium, beryllium, cobalt, selenium, thallium, vanadium; therefore HIs do not include these chemicals
HQ = Sample Conc/Sediment Effect Conc
HI = Sum of HQs